



## DoD Executive Agent

Office of the  
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of the Army  
(Installations and  
Environment)

# Geothermal Energy Demonstration at Fort Indiantown Gap

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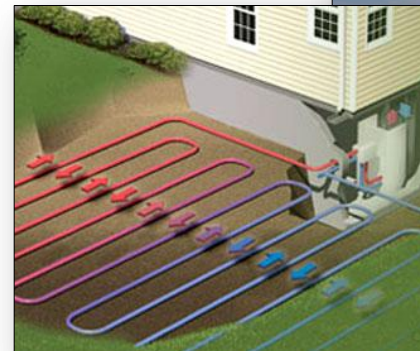
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**Technology Transition – Supporting DoD Readiness, Sustainability, and the Warfighter**

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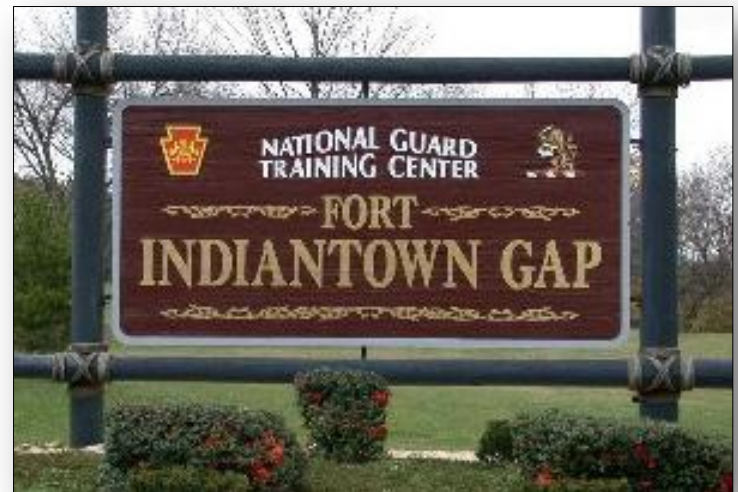
# National Guard Energy Awareness

- Pennsylvania National Guard (PANG) is seeking to:
  - Reduce energy consumption
  - Reduce use of fossil fuels
  - Become energy independent
  - Increase use of sustainable energy technology
- Challenges faced by PANG include:
  - Higher energy costs as a result of price rate increases
  - Outdated facilities, 50+ years
  - Lack of funding for repairs and renovations.



# Demonstration Site

- Fort Indiantown Gap (FTIG) was chosen as the location for an alternative energy technology demonstration.
  - Largest PANG installation
  - 17,000 acres and 140 training areas and facilities
  - Provides year-round training for military forces, law enforcement agents, and civilians



# Demonstration Site (continued)

- Selected buildings 4-201 & 4-202 for demonstration
  - 4-201 selected for geothermal installation
  - 4-202 selected for energy consumption baseline comparison



- Identical design/construction – provides good energy comparison
- Open floor plan – each is approximately 4,890 square feet in size
- Recently constructed – May 2008
- Features updated energy-efficient fixtures – programmable thermostats
- Used for Soldier Readiness Processing (SRP) by units departing and returning from military deployments

# Technology Assessment

- Conducted technology assessment in October 2008.
- Identified alternative technology options.

<i>Technology</i>	<i>System Description</i>	<i>Rate</i>	<i>Payback (yrs)</i>	<i>30-Year NPV</i>
Photovoltaic	5-kW Regular System	DOE Projected Fuel Price Indices for Propane	>30	(\$68,455)
		End of Rate Cap (Conservative Estimate)	>30	(\$64,820)
		End of Rate Cap (Aggressive Estimate)	>30	(\$60,325)
Concentrator Photovoltaic	25-kW Concentrator System	DOE Projected Fuel Price Indices for Propane	>30	(\$246,390)
		End of Rate Cap (Conservative Estimate)	>30	(\$222,380)
		End of Rate Cap (Aggressive Estimate)	>30	(\$192,691)
Wind Turbine	5-kW System	DOE Projected Fuel Price Indices for Propane	>30	(\$88,329)
		End of Rate Cap (Conservative Estimate)	>30	(\$83,660)
		End of Rate Cap (Aggressive Estimate)	>30	(\$77,886)
Geothermal	8-ton System	DOE Projected Fuel Price Indices for Propane	11	\$44,707
		End of Rate Cap (Conservative Estimate)	13	\$30,485
		End of Rate Cap (Aggressive Estimate)	16	\$12,899
Fuel Cell	5-kW System	DOE Projected Fuel Price Indices for Propane	>30	(\$130,540)
		End of Rate Cap (Conservative Estimate)	>30	(\$104,391)
		End of Rate Cap (Aggressive Estimate)	>30	(\$72,058)

## Lowest Payback for Rate

## Highest NPV for Rate

Calculations do not include cost of natural gas. Full calculations were not conducted due to 5-yr life expectancy of equipment.



# Geothermal Heat Pump System

- Recommended geothermal heat pump system as the most economically viable system
  - Selected closed loop vertical well system
  - Takes advantage of seasonal temperature differences between air and ground temperature
  - Moves heat from ground to building in winter and from building to ground in summer

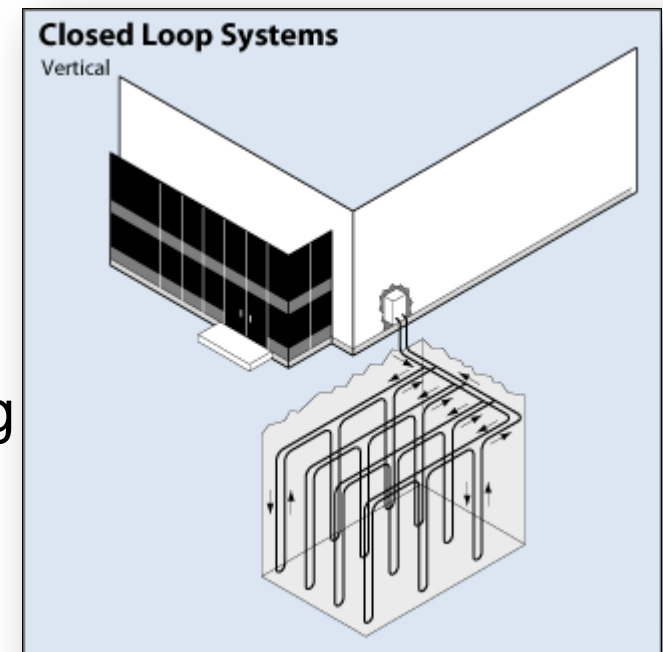


Diagram courtesy of EERE.

# Demonstration Goals

- Evaluate life-cycle cost of ground-source heat pump heating/cooling systems
  - Determine savings from reduced propane usage
- Evaluate environmental benefits of ground-source heat pump system compared to propane gas heating and electric air cooling system





# Well Drilling

- Installed 8-ton geothermal system outside of building 4-201 in April 2009



- Installation included the drilling of 6 wells at an average depth of 220 ft and piping connected to building 4-201.

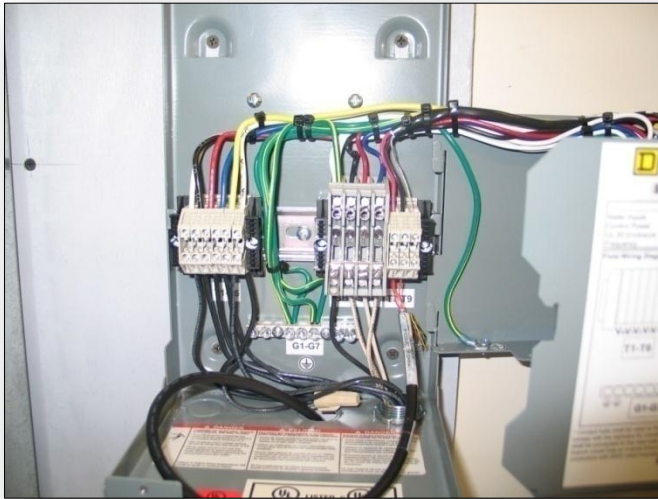
# Heat Pump Installation



- Heat pump system replaced the conventional HVAC system.
- Propane backup heater was kept in building 4-201 for use during geothermal startup.

# System Commissioning

- Entire system was commissioned in July 2009.



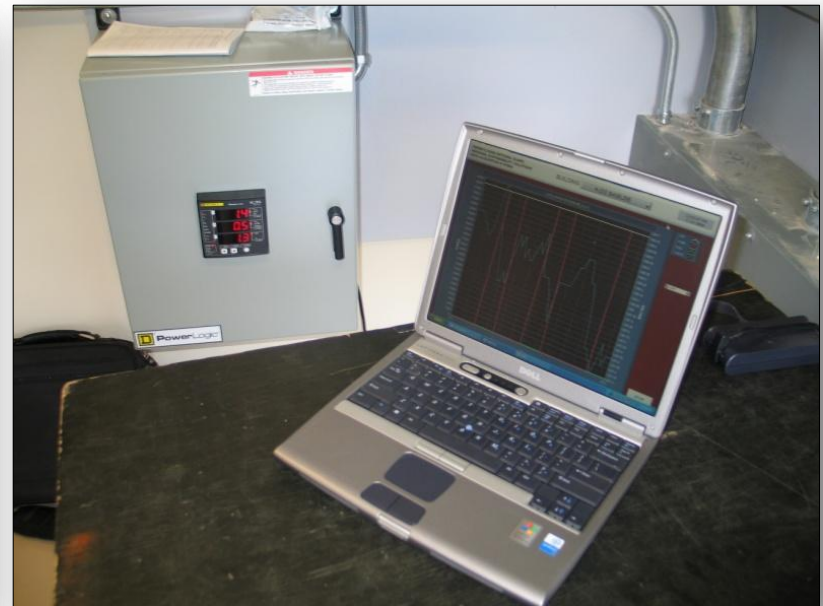
- Duct work was evaluated for proper air flow.
- Electrical panels were configured for metering/monitoring.





# Data Collection

- Data collecting software was installed on laptops placed at each location.
  - Laptops are collecting electrical information from the electrical panels in each building.

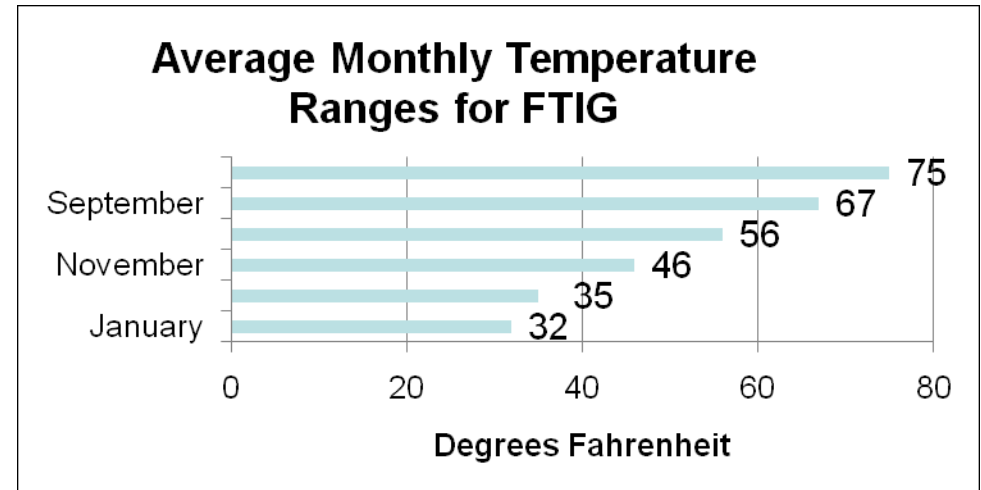


# Data Collection (continued)

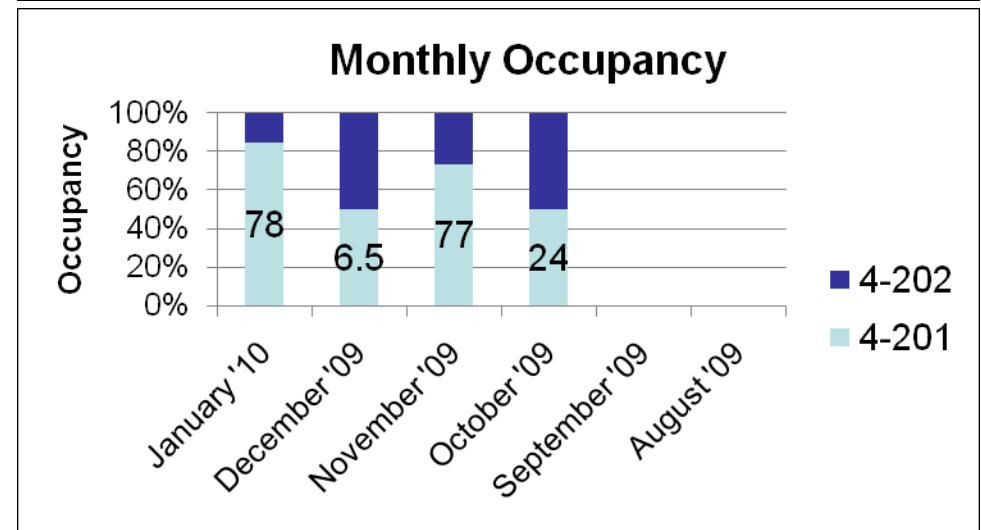
- Electrical data will record:
  - Voltage
  - Current
  - Kilowatt.
- Additional collected information includes:
  - Occupancy schedules of buildings
  - Weather/temperature information of FTIG.

# Current Results

Average monthly temperatures at FTIG:



Average occupancy of Buildings 4-201 and 4-202:





## Current Results (continued)



*As of December 2009, PANG saved over 600 gallons of propane by using the geothermal heat pump system.*

- The propane savings is even greater considering the extensive use of building 4-201 compared to 4-202.
- A more accurate volume of propane usage will be calculated at the end of the technology demonstration.

# Conclusions

- Electrical data is being collected monthly through August 2010.
- Period of performance was extended so that one full year of data could be gathered.
  - A full year of monitoring provides both summer and winter data – seasons when the geothermal heat pump will be heavily utilized.
- Upon completion of demonstration:
  - Collected data will be analyzed
  - Cost benefit analysis will be developed.
- Demonstration findings will be used by PANG and other National Guard entities to determine the feasibility of implementing the technology regionally.

# Path Forward

- Follow-on geothermal project has started at FTIG
- Include design of 3<sup>rd</sup> building similar in design to buildings 4-201 and 4-202
  - LEED Silver Certified
  - Energy efficient features
  - Installation of geothermal heat pump system
- Will use 4-201 and 4-202 as baseline comparisons
  - 4-201 – baseline
  - 4-202 – with geothermal
  - 3<sup>rd</sup> building – LEED with geothermal



Image courtesy of USGBC.



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